CLAIMS

What is claimed is:

1. A tissue treatment system, comprising:

an ablation probe having an ablative element and at least one perfusion exit port;

a source of ablation energy operably coupled to the ablative element;

a pump assembly operably coupled to the at least one perfusion exit port; and

a feedback device configured for controlling the amount of infusaid displaced by the pump assembly based on a sensed tissue parameter.

2. The tissue treatment system of claim 1, wherein the feedback device comprises a sensor configured for sensing the tissue parameter, and a perfusion controller coupled to the sensor and the pump assembly, the perfusion controller configured for controlling the pump assembly based on the sensed tissue parameter.

3. The tissue treatment system of claim 1, wherein the feedback device comprises a perfusion control valve associated with the distal end of the shaft, the perfusion control valve forming the at least one perfusion exit port, wherein the perfusion control valve changes the size of the at least one perfusion exit port based on the sensed tissue parameter.

4. The tissue treatment system of claim 1, wherein the ablation probe is rigid.

5. The tissue treatment system of claim 1, wherein the ablative element comprises at least one electrode.

6. The tissue treatment system of claim 5, wherein the at least one electrode is a single needle electrode.

7. The tissue treatment system of claim 5, wherein the at least one electrode comprises a needle electrode array.

8. The tissue treatment system of claim 1, wherein the source of ablation energy is a radio frequency generator.

9. The tissue treatment system of claim 1, wherein the pump assembly is external to the ablation probe.

10. The tissue treatment system of claim 1, wherein the pump assembly is carried by the ablation probe.

11. The tissue treatment system of claim 1, further comprising a source of infusaid, wherein the pump assembly is configured for pumping the infusaid from the infusaid source out through the at least one perfusion exit port.

12. The tissue treatment system of claim 1, wherein the tissue parameter is temperature.

13. The tissue treatment system of claim 1, wherein the tissue parameter is impedance.

14. The tissue treatment system of claim 1, wherein the ablative element is mechanically associated with the feedback device.

15. A method of treating tissue, comprising:

ablating the tissue;

sensing a parameter of the tissue; and

perfusing the tissue with an infusaid based on the sensed tissue parameter.

16. The method of claim 15, wherein the tissue is ablated using radio frequency energy.

17. The method of claim 15, wherein the tissue is perfused with the infusaid during the tissue ablation.

18. The method of claim 15, wherein the tissue parameter is temperature.

19. The method of claim 17, wherein the tissue perfusion is commenced when the sensed temperature surpasses a first temperature threshold.

20. The method of claim 19, wherein the tissue perfusion is ceased when the sensed temperature drops below a second temperature threshold.

21. The method of claim 15, wherein the tissue parameter is impedance.

22. The method of claim 21, wherein the tissue perfusion is commenced when the sensed impedance surpasses a first impedance threshold.

23. The method of claim 21, wherein the tissue perfusion is ceased when the sensed impedance drops below a second impedance threshold.

24. A tissue treatment system, comprising:

an ablation probe having an ablative element and at least one perfusion exit port;

a source of ablation energy operably coupled to the ablative element;

a pump assembly operably coupled to the at least one perfusion exit port;

a sensor configured for sensing a tissue parameter; and

a perfusion controller coupled to the sensor and the pump assembly, the perfusion controller configured for controlling the pump assembly based on the tissue parameter sensed by the sensor.

25. The tissue treatment system of claim 0, wherein the ablation probe is rigid.

26. The tissue treatment system of claim 0, wherein the ablative element comprises at least one electrode.

27. The tissue treatment system of claim 25, wherein the at least one electrode is a single needle electrode.

28. The tissue treatment system of claim 25, wherein the at least one electrode comprises a needle electrode array.

29. The tissue treatment system of claim 0, wherein the at least one perfusion exit port comprises a plurality of side ports.

30. The tissue treatment system of claim 0, wherein the at least one perfusion exit port is carried by the ablative element.

31. The tissue treatment system of claim 0, wherein the source of ablation energy is a radio frequency generator.

32. The tissue treatment system of claim 0, wherein the pump assembly is external to the ablation probe.

33. The tissue treatment system of claim 0, wherein the pump assembly is carried by the ablation probe.

34. The tissue treatment system of claim 0, further comprising a source of infusaid, wherein the pump assembly is configured for pumping the infusaid from the infusaid source out through the at least one perfusion exit port.

35. The tissue treatment system of claim 0, wherein the tissue parameter is temperature.

36. The tissue treatment system of claim 0, wherein the sensor is mechanically associated with the ablative element.

37. The tissue treatment system of claim 0, wherein the ablative element is the sensor.

38. The tissue treatment system of claim 35, wherein the perfusion controller is configured for commanding the pump assembly to pump infusaid through the at least one perfusion exit port when the tissue temperature is above a temperature threshold, and is configured for commanding the pump assembly to cease pumping infusaid through the at least one perfusion exit port when the tissue temperature is below the temperature threshold.

39. The tissue treatment system of claim 0, wherein the tissue parameter is impedance.

40. The tissue treatment system of claim 39, wherein the perfusion controller is configured for commanding the pump assembly to pump infusaid through the at least one perfusion exit port when the tissue impedance is above an impedance threshold, and is configured for commanding the pump assembly to cease pumping infusaid through the at least one perfusion exit port when the tissue impedance is below the impedance threshold.

41. An ablation probe, comprising:

an elongate shaft having a distal end;

an ablative element disposed on the distal end of the shaft;

a perfusion lumen longitudinally extending within the shaft; and

a perfusion control valve associated with the distal end of the shaft, the perfusion control valve having perfusion exit port, the size of which changes with temperature.

42. The ablation probe of claim 41, wherein the perfusion control valve comprises a reed valve having at least one reed.

43. The ablation probe of claim 42, wherein each of the at least one reed comprises a bi-metallic flange that bends in the presence of a temperature change.

44. The ablation probe of claim 42, wherein each of the at least one reed comprises a nitinol flange that bends in the presence of a temperature change.

45. The ablation probe of claim 42, wherein the at least one reed comprises four reeds.

46. The ablation probe of claim 42, wherein the at least one reed comprises a pair of opposing reeds.

47. The ablation probe of claim 41, wherein the shaft is rigid.

48. The ablation probe of claim 41, wherein the ablative element comprises at least one electrode.

49. The ablation probe of claim 48, wherein the at least one electrode is a single needle electrode.

50. The ablation probe of claim 41, wherein the perfusion control valve forms at least a portion of the ablative element.

51. The ablation probe of claim 41, further comprising a pump assembly configured for pumping infusaid through the perfusion lumen.

52. The ablation probe of claim 51, wherein the pump assembly is carried by a proximal end of the shaft.

53. An ablation probe, comprising:

an elongate shaft having a distal end;

an ablative element disposed on the distal end of the shaft;

a perfusion lumen longitudinally extending within the shaft;

at least one perfusion exit port in fluid communication with the perfusion lumen; and

a wicking material disposed in the perfusion lumen.

54. The ablation probe of claim 53, wherein the one or more perfusion exit ports comprises side ports.

55. The ablation probe of claim 53, wherein the at least one perfusion exit port is carried by the ablative element.

56. The ablation probe of claim 53, wherein the shaft is rigid.

57. The ablation probe of claim 53, wherein the ablative element comprises at least one electrode.

58. The ablation probe of claim 57, wherein the at least one electrode is a single needle electrode.

59. The ablation probe of claim 57, wherein the at least one electrode comprises a needle electrode array.

60. The ablation probe of claim 53, wherein the wicking material is disposed within the entire length of the perfusion lumen.

61. The ablation probe of claim 53, wherein the wicking material is composed of cotton or fabric.

62. The ablation probe of claim 53, further comprising a pump assembly configured for pumping infusaid through the perfusion lumen.

63. The ablation probe of claim 62, wherein the pump assembly is carried by a proximal end of the shaft.

64. A tissue treatment system, comprising:

an ablation probe including an elongate shaft having a distal end, an ablative element disposed on the distal end of the shaft, a perfusion lumen longitudinally extending within the shaft, at least one perfusion exit port in fluid communication with the perfusion lumen; and a wicking material disposed in the perfusion lumen;

a source of ablation energy operably coupled to the ablative element; and

a source of infusaid operably coupled to the at least one perfusion exit port via the perfusion lumen.

65. The tissue treatment system of claim 64, wherein the wicking material is disposed within the entire length of the perfusion lumen.

66. The tissue treatment system of claim 64, wherein the wicking material is composed of cotton or fabric.

67. The tissue treatment system of claim 64, wherein the shaft is rigid.

68. The tissue treatment system of claim 64, wherein the one or more perfusion exit ports comprises side ports.

69. The tissue treatment system of claim 64, wherein the at least one perfusion exit port is carried by the ablative element.

70. The tissue treatment system of claim 64, wherein the ablative element comprises at least one electrode.

71. The tissue treatment system of claim 70, wherein the at least one electrode is a single needle electrode.

72. The tissue treatment system of claim 70, wherein the at least one electrode comprises a needle electrode array.

73. The tissue treatment system of claim 64, wherein the source of ablation energy is a radio frequency generator.

74. The tissue treatment system of claim 64, further comprising a pump assembly configured for pumping infusaid from the infusaid source through the perfusion lumen.

75. The tissue treatment system of claim 74, wherein the pump assembly is external to the ablation probe.

76. The tissue treatment system of claim 74, wherein the pump assembly is carried by the ablation probe.

77. An ablation probe, comprising:

an elongate shaft having a proximal end and a distal end;

an ablative element disposed on the distal end of the shaft;

a perfusion lumen longitudinally extending within the shaft;

at least one perfusion exit port in fluid communication with the perfusion lumen; and

a pump assembly carried by the proximal end of the shaft, the pump assembly configured for pumping infusaid through the perfusion lumen and out the at least one perfusion exit port.

78. The ablation probe of claim 77, wherein the one or more perfusion exit ports comprises side ports.

79. The ablation probe of claim 77, wherein the at least one perfusion exit port is carried by the ablative element.

80. The ablation probe of claim 77, wherein the shaft is rigid.

81. The ablation probe of claim 77, wherein the ablative element comprises at least one electrode.

82. The ablation probe of claim 81, wherein the at least one electrode is a single needle electrode.

83. The ablation probe of claim 81, wherein the at least one electrode comprises a needle electrode array.

84. The ablation probe of claim 77, wherein the pump assembly comprises a reservoir for storing the infusaid.

85. The ablation probe of claim 84, further comprising a perfusion inlet port configured for transferring infusaid from an external source into the reservoir.

86. The ablation probe of claim 85, further comprising a one-way check valve between the perfusion inlet port and the reservoir, the check valve configured for preventing the infusaid from being conveyed from the reservoir back through the perfusion inlet port.

87. The ablation probe of claim 85, further comprising a one-way check valve between the perfusion lumen and the reservoir, the check valve configured for preventing the infusaid from being conveyed from the perfusion lumen back into the reservoir.

88. The ablation probe of claim 84, further comprising a one-way check valve between the perfusion lumen and the reservoir, the check valve configured for preventing the infusaid from being conveyed from the perfusion lumen back into the reservoir.

89. The ablation probe of claim 84, wherein the pump assembly comprises a diaphragm adjacent the reservoir, the diaphragm having a pumping stroke that displaces the infusaid from the reservoir into the perfusion lumen, and a return stroke that displaces infusaid from an external source into the reservoir.

90. The ablation probe of claim 89, wherein the pump assembly comprises a piezoelectric element configured for vibrating the diaphragm between pumping and return strokes.

91. The ablation probe of claim 84, wherein the pump assembly comprises an elastomeric diaphragm adjacent the reservoir, wherein the diaphragm is configured for expanding to pressurize the reservoir in response to the conveyance of infusaid into the reservoir.

92. The ablation probe of claim 84, wherein the pump assembly comprises a plunger disposed in the reservoir and a spring configured to displace the plunger within the reservoir in one direction to pressurize the reservoir.

93. The ablation probe of claim 92, wherein the plunger is configured to be displaced in another direction to displace infusaid from an external source into the reservoir.